CLAIMS

1. An electron beam substrate processing apparatus, comprising:

a substrate processing chamber defined by sidewalls, a bottom, and a top;

a spindle motor assembly moveably disposed within the substrate processing chamber;

a spindle shaft extending from the spindle motor assembly toward the top;

a substrate support member mounted to an end of the spindle shaft distal the spindle motor assembly;

an encoder wheel coupled to the spindle shaft and positioned adjacent the substrate support member;

an optical detector positioned in optical communication with the encoder wheel, the optical detector being configured to generate rotation data signals in response to detected rotation of the encoder wheel;

a pattern generator circuit configured to generate an electron beam control signal in response to the rotation data signals, wherein the electron beam control signal frequency varies as a function of at least one processing radius and angular velocity associated thereto; and

an electron beam assembly responsive to the electron beam control signal, the electron beam assembly being disposed on the substrate processing chamber and configured to direct the electron beam onto a surface of the substrate for processing.

2. The apparatus of claim 1, further comprising an actuator coupled to the spindle motor assembly and configured to move the spindle motor assembly in a horizontal motion relative a longitudinal axis of the spindle shaft.

3. The apparatus of claim 1, further comprising a vacuum pump coupled to the substrate processing chamber to provide a vacuum therein.

4. The apparatus of claim 1, wherein the apparatus comprises a motor speed control circuit configured to process at least some of the rotation data signals to control a rotation velocity of the spindle shaft.

5. The apparatus of claim 1, wherein the apparatus comprises a signal processing circuit configured to provide clock data signals to the pattern generation circuit that vary as a function of the at least one processing radius in response to at least some of the rotation data signals received thereto.

6. A method of processing substrates with an electron beam processing system, comprising:

rotating a substrate support member configured to hold the substrate thereon for processing;

generating rotation data signals from one encoder assembly associated with a rotational movement of the substrate support member;

generating pattern clock signals from the rotation data signals that vary in frequency as a function of at least one processing radius and an angular velocity associated thereto; and

generating an electron beam processing pattern for writing a pattern on a surface of the substrate from at least some of the pattern clock signals, wherein the processing pattern varies in angular dimension as a function of the at least one processing radius.

7. The method of claim 6, wherein the generating rotation data signals comprises optically detecting the rotational movements of an encoder wheel in axial alignment with the rotating substrate support member.

8. The method of claim 6, further comprises processing at least some of the rotation data signals with a motor control circuit configured to maintain one or more desired rotational speeds of the substrate support member.

9. The method of claim 6, wherein the generating pattern clock signals comprises generating the frequency of the pattern clock signals proportional to a change of the at least one processing radius.

10. The method of claim 6, wherein the generating the electron beam processing pattern comprises generating an electron beam control signal having a frequency that varies as function of the at least one processing radius.

11. The method of claim 10, wherein the generating the electron beam control signal comprises processing the pattern clock signals having the frequency that varies as function of the at least one processing radius to generate the electron beam control signal.

12. The method of claim 11, wherein the processing the pattern clock signals comprises determining the at least one processing radius and determining a frequency of the pattern clock signal associated with the at least one processing radius.

13. An apparatus for processing a substrate with electron beams, comprising:

rotation means for rotating a substrate support member for processing the substrate thereon;

signal generator means for generating a rotation clock signal from the axial rotation of the substrate;

means for generating a pattern clock signal from the axial rotation of the substrate that varies in frequency as a function of radial processing position and angular velocity of the substrate associated thereto; and

an electron beam generation means for processing the substrate with electron beams associated with the pattern clock signal.

14. The apparatus of claim 13, further comprising processor means for processing the pattern clock signal to provide a substrate process pattern therefrom

to the electron beam generation means that varies with the radial processing position.

15. The apparatus of claim 13, wherein the rotation means comprises a movable spindle motor assembly having a spindle shaft extending therefrom coupled on one end to the substrate support member.

16. The apparatus of claim 13, wherein the signal generator means comprises at least one encoder wheel positioned on the spindle shaft parallel to and adjacent a substrate support member configured to support the substrate thereon for processing.

17. The apparatus of claim 13, wherein the signal generator means comprises a means for detecting timing marks on the at least one encoder wheel to generate the rotation clock signals.

18. The apparatus of claim 13, wherein the means for generating the pattern clock signal comprises a pattern clock generation circuit.

19. The apparatus of claim 18, wherein the pattern clock generation circuit comprises a digital phase locked loop circuit configured to provide the pattern clock signal in response to the rotation clock signal.

20. The apparatus of claim 19, wherein the phase locked loop comprises a loop bandwidth control circuit configured to vary the loop bandwidth of the phase locked loop as a function of at least one of the frequencies of the pattern clock signal.